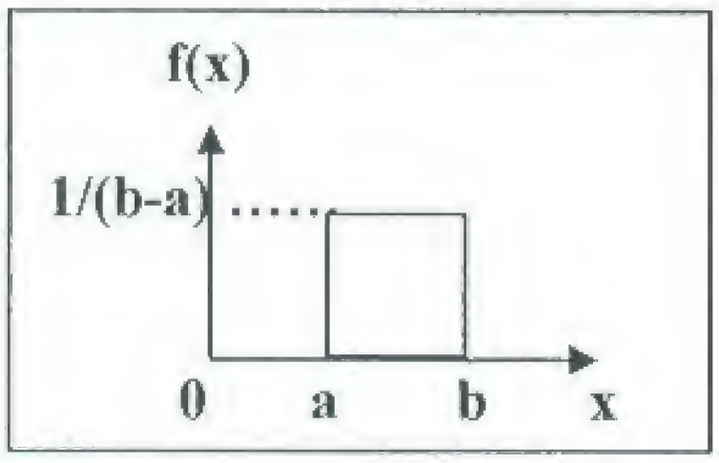
## Question No. 3 *(18 marks)*

**(a)** A fair die is tossed. Let X denote twice the number appearing, and let Y denote 1 or 4 according as an odd or an even number appears. **Find the probability, expectation, variance and standard deviation of:**

**i) X** **ii) Y** **iii) X+Y** **iv) XY**

**(b)** For the uniform distribution shown in the following figure,




**prove that:**

**a) Mean = (b+a)/2**

**b) Variance = $(b-a)^2/12$**

**(c)** A family has 6 children. Find the probability P that there are:

**i. 3 boys and 3 girls.**

**ii. Fewer boys than girls.**

## Question No. 4 *(18 marks)*

**(a)** Let X be a random variable with the standard normal distribution Φ. **Find:**

i. $P(0 \leq X \leq 1.24)$

ii. $P(-0.73 \leq X \leq 0)$

iii. $P(0.65 \leq X \leq 1.26)$

**(b)** The mean and standard deviation on an examination are 74 and 12 respectively. **Find the scores in standard units of students receiving marks**:

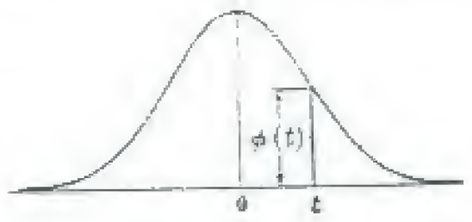
i) 65 ii) 74 iii) 86 iv) 92

**(c)** Suppose the temperature during June is normally distributed with mean 20°C and standard deviation 3.33 deg. Find the **probability** P that the temprature is between 21.11°C and 26.66°C.

***Best wishes***

## STANDARD NORMAL CURVE ORDINATES

This table gives values $\phi(t)$ of the standard normal distribution $\phi$ at $t \geqq 0$ in steps of 0.01.



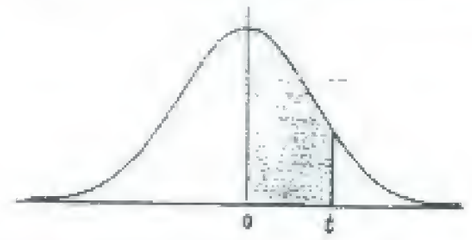

| t | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | .3989 | .3989 | .3989 | .3988 | .3986 | .3984 | .3982 | .3980 | .3977 | .3973 |
| 0.1 | .3970 | .3965 | .3961 | .3956 | .3951 | .3945 | .3939 | .3932 | .3925 | .3918 |
| 0.2 | .3910 | .3902 | .3894 | .3885 | .3876 | .3867 | .3857 | .3847 | .3836 | .3825 |
| 0.3 | .3814 | .3802 | .3790 | .3778 | .3765 | .3752 | .3739 | .3725 | .3712 | .3697 |
| 0.4 | .3683 | .3668 | .3653 | .3637 | .3621 | .3605 | .3589 | .3572 | .3555 | .3538 |
| 0.5 | .3521 | .3503 | .3485 | .3467 | .3448 | .3429 | .3410 | .3391 | .3372 | .3352 |
| 0.6 | .3332 | .3312 | .3292 | .3271 | .3251 | .3230 | .3209 | .3187 | .3166 | .3144 |
| 0.7 | .3123 | .3101 | .3079 | .3056 | .3034 | .3011 | .2989 | .2966 | .2943 | .2920 |
| 0.8 | .2897 | .2874 | .2850 | .2827 | .2803 | .2780 | .2756 | .2732 | .2709 | .2685 |
| 0.9 | .2661 | .2637 | .2613 | .2589 | .2565 | .2541 | .2516 | .2492 | .2468 | .2444 |
| 1.0 | .2420 | .2396 | .2371 | .2347 | .2323 | .2299 | .2275 | .2251 | .2227 | .2203 |
| 1.1 | .2179 | .2155 | .2131 | .2107 | .2083 | .2059 | .2036 | .2012 | .1989 | .1965 |
| 1.2 | .1942 | .1919 | .1895 | .1872 | .1849 | .1826 | .1804 | .1781 | .1758 | .1736 |
| 1.3 | .1714 | .1691 | .1669 | .1647 | .1626 | .1604 | .1582 | .1561 | .1539 | .1518 |
| 1.4 | .1497 | .1476 | .1456 | .1435 | .1415 | .1394 | .1374 | .1354 | .1334 | .1315 |
| 1.5 | .1295 | .1276 | .1257 | .1238 | .1219 | .1200 | .1182 | .1163 | .1145 | .1127 |
| 1.6 | .1109 | .1092 | .1074 | .1057 | .1040 | .1023 | .1006 | .0989 | .0973 | .0957 |
| 1.7 | .0940 | .0925 | .0909 | .0893 | .0878 | .0863 | .0848 | .0833 | .0818 | .0804 |
| 1.8 | .0790 | .0775 | .0761 | .0748 | .0734 | .0721 | .0707 | .0694 | .0681 | .0669 |
| 1.9 | .0656 | .0644 | .0632 | .0620 | .0608 | .0596 | .0584 | .0573 | .0562 | .0551 |
| 2.0 | .0540 | .0529 | .0519 | .0508 | .0498 | .0488 | .0478 | .0468 | .0459 | .0449 |
| 2.1 | .0440 | .0431 | .0422 | .0413 | .0404 | .0396 | .0387 | .0379 | .0371 | .0363 |
| 2.2 | .0355 | .0347 | .0339 | .0332 | .0325 | .0317 | .0310 | .0303 | .0297 | .0290 |
| 2.3 | .0283 | .0277 | .0270 | .0264 | .0258 | .0252 | .0246 | .0241 | .0235 | .0229 |
| 2.4 | .0224 | .0219 | .0213 | .0208 | .0203 | .0198 | .0194 | .0189 | .0184 | .0180 |
| 2.5 | .0175 | .0171 | .0167 | .0163 | .0158 | .0154 | .0151 | .0147 | .0143 | .0139 |
| 2.6 | .0136 | .0132 | .0129 | .0126 | .0122 | .0119 | .0116 | .0113 | .0110 | .0107 |
| 2.7 | .0104 | .0101 | .0099 | .0096 | .0093 | .0091 | .0088 | .0086 | .0084 | .0081 |
| 2.8 | .0079 | .0077 | .0075 | .0073 | .0071 | .0069 | .0067 | .0065 | .0063 | .0061 |
| 2.9 | .0060 | .0058 | .0056 | .0055 | .0053 | .0051 | .0050 | .0048 | .0047 | .0046 |
| 3.0 | .0044 | .0043 | .0042 | .0040 | .0039 | .0038 | .0037 | .0036 | .0035 | .0034 |
| 3.1 | .0033 | .0032 | .0031 | .0030 | .0029 | .0028 | .0027 | .0026 | .0025 | .0025 |
| 3.2 | .0024 | .0023 | .0022 | .0022 | .0021 | .0020 | .0020 | .0019 | .0018 | .0018 |
| 3.3 | .0017 | .0017 | .0016 | .0016 | .0015 | .0015 | .0014 | .0014 | .0013 | .0013 |
| 3.4 | .0012 | .0012 | .0012 | .0011 | .0011 | .0010 | .0010 | .0010 | .0009 | .0009 |
| 3.5 | .0009 | .0008 | .0008 | .0008 | .0008 | .0007 | .0007 | .0007 | .0007 | .0006 |
| 3.6 | .0006 | .0006 | .0006 | .0005 | .0005 | .0005 | .0005 | .0005 | .0005 | .0004 |
| 3.7 | .0004 | .0004 | .0004 | .0004 | .0004 | .0004 | .0003 | .0003 | .0003 | .0003 |
| 3.8 | .0003 | .0003 | .0003 | .0003 | .0003 | .0002 | .0002 | .0002 | .0002 | .0002 |
| 3.9 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 | .0001 | .0001 |

Table 6.1



## STANDARD NORMAL CURVE AREAS

This table gives areas under the standard normal distribution $\phi$ between 0 and $t \geqq 0$ in steps of 0.01.




| t | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | .0000 | .0040 | .0080 | .0120 | .0160 | .0199 | .0239 | .0279 | .0319 | .0359 |
| 0.1 | .0398 | .0438 | .0478 | .0517 | .0557 | .0596 | .0636 | .0675 | .0714 | .0754 |
| 0.2 | .0793 | .0832 | .0871 | .0910 | .0948 | .0987 | .1026 | .1064 | .1103 | .1141 |
| 0.3 | .1179 | .1217 | .1255 | .1293 | .1331 | .1368 | .1406 | .1443 | .1480 | .1517 |
| 0.4 | .1554 | .1591 | .1628 | .1664 | .1700 | .1736 | .1772 | .1808 | .1844 | .1879 |
| 0.5 | .1915 | .1950 | .1985 | .2019 | .2054 | .2088 | .2123 | .2157 | .2190 | .2224 |
| 0.6 | .2258 | .2291 | .2324 | .2357 | .2389 | .2422 | .2454 | .2486 | .2518 | .2549 |
| 0.7 | .2580 | .2612 | .2642 | .2673 | .2704 | .2734 | .2764 | .2794 | .2823 | .2852 |
| 0.8 | .2881 | .2910 | .2939 | .2967 | .2996 | .3023 | .3051 | .3078 | .3106 | .3133 |
| 0.9 | .3159 | .3186 | .3212 | .3238 | .3264 | .3289 | .3315 | .3340 | .3365 | .3389 |
| 1.0 | .3413 | .3438 | .3461 | .3485 | .3508 | .3531 | .3554 | .3577 | .3599 | .3621 |
| 1.1 | .3643 | .3665 | .3686 | .3708 | .3729 | .3749 | .3770 | .3790 | .3810 | .3830 |
| 1.2 | .3849 | .3869 | .3888 | .3907 | .3925 | .3944 | .3962 | .3980 | .3997 | .4015 |
| 1.3 | .4032 | .4049 | .4066 | .4082 | .4099 | .4115 | .4131 | .4147 | .4162 | .4177 |
| 1.4 | .4192 | .4207 | .4222 | .4236 | .4251 | .4265 | .4279 | .4292 | .4306 | .4319 |
| 1.5 | .4332 | .4345 | .4357 | .4370 | .4382 | .4394 | .4406 | .4418 | .4429 | .4441 |
| 1.6 | .4452 | .4463 | .4474 | .4484 | .4495 | .4505 | .4515 | .4525 | .4535 | .4545 |
| 1.7 | .4554 | .4564 | .4573 | .4582 | .4591 | .4599 | .4608 | .4616 | .4625 | .4633 |
| 1.8 | .4641 | .4649 | .4656 | .4664 | .4671 | .4678 | .4686 | .4693 | .4699 | .4706 |
| 1.9 | .4713 | .4719 | .4726 | .4732 | .4738 | .4744 | .4750 | .4756 | .4761 | .4767 |
| 2.0 | .4772 | .4778 | .4783 | .4788 | .4793 | .4798 | .4803 | .4808 | .4812 | .4817 |
| 2.1 | .4821 | .4826 | .4830 | .4834 | .4838 | .4842 | .4846 | .4850 | .4854 | .4857 |
| 2.2 | .4861 | .4864 | .4868 | .4871 | .4875 | .4878 | .4881 | .4884 | .4887 | .4890 |
| 2.3 | .4893 | .4896 | .4898 | .4901 | .4904 | .4906 | .4909 | .4911 | .4913 | .4916 |
| 2.4 | .4918 | .4920 | .4922 | .4925 | .4927 | .4929 | .4931 | .4932 | .4934 | .4936 |
| 2.5 | .4938 | .4940 | .4941 | .4943 | .4945 | .4946 | .4948 | .4949 | .4951 | .4952 |
| 2.6 | .4953 | .4955 | .4956 | .4957 | .4959 | .4960 | .4961 | .4962 | .4963 | .4964 |
| 2.7 | .4965 | .4966 | .4967 | .4968 | .4969 | .4970 | .4971 | .4972 | .4973 | .4974 |
| 2.8 | .4974 | .4975 | .4976 | .4977 | .4977 | .4978 | .4979 | .4979 | .4980 | .4981 |
| 2.9 | .4981 | .4982 | .4982 | .4983 | .4984 | .4984 | .4985 | .4985 | .4986 | .4986 |
| 3.0 | .4987 | .4987 | .4987 | .4988 | .4988 | .4989 | .4989 | .4989 | .4990 | .4990 |
| 3.1 | .4990 | .4991 | .4991 | .4991 | .4992 | .4992 | .4992 | .4992 | .4993 | .4993 |
| 3.2 | .4993 | .4993 | .4994 | .4994 | .4994 | .4994 | .4994 | .4995 | .4995 | .4995 |
| 3.3 | .4995 | .4995 | .4995 | .4996 | .4996 | .4996 | .4996 | .4996 | .4996 | .4997 |
| 3.4 | .4997 | .4997 | .4997 | .4997 | .4997 | .4997 | .4997 | .4997 | .4997 | .4998 |
| 3.5 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 |
| 3.6 | .4998 | .4998 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 |
| 3.7 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 |
| 3.8 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 |
| 3.9 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 |

Table 6.2

Course Title: **Fundamentals of Stochastic Processes** أسس العمليات العشوائية Course Code: CCE3117 3rd year
Date: 11.1.2012 (First term) Allowed time: 3 hrs No. of Pages: (2)

Answer the following four questions. You are allowed to use the tables of standard normal curve ordinates and areas in your answers.

## Question No. 1

*(16 marks)*

**(a)** Let A and B be events with P(A)=3/8, P(B)=5/8 and P(AUB)=3/4. **Find P(A/B) and P(B/A).**

**(b)** A box contains 7 red marbles and 3 white marbles. Three marbles are drawn from the box one after the other. **Find the probability that the first two are red and the third is white.**

**(c)** In a certain collage, 25% of the students failed mathematics, 15% of the students failed chemistry and 10% of the students failed both. A student is selected at random:

i. If he failed chemistry, **what is the probability that he failed mathematics**?
ii. If he failed mathematics, **what is the probability that he failed chemistry?**
iii. **What is the probability that he failed mathematics or chemistry?**

## Question No. 2

*(18 marks)*

**(a)** Medical research has shown that a certain type of chemotherapy is successful 70% of the time when used to treat skin cancer. Suppose five skin cancer patients are treated with this type of chemotherapy and let x equal the number of successful cures out of the five. The probability distribution of x is given in the following table:

| X | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| P(x) | 0.002 | 0.029 | 0.132 | 0.309 | 0.360 | 0.168 |

a) **Find $\mu = E(x)$. Interpret the result.**
b) **Find $\sigma = \sqrt{E(x-\mu)^2}$. Interpret the result.**

**(b)** Prove that for any random variable x:

a) $E(ax + b) = a\,E(x) + b$
b) $V(ax + b) = a^2\,V(x)$

**(c)** Let x be a continuous random variable with density:

$$f(x) = \begin{cases} K(2-x) & 0 \le x \le 2 \\ 0 & \text{elsewhere} \end{cases}$$

**Evaluate K and find the cumulative distribution function.**

**Tanta university**
**Automatic Control and Computer Depart.**
**Final Term Exam- January 2012**

**Faculty of Engineering**
**Third Year- Compiler and Languages**
**Time 3 hours**

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**Answer All Questions**

**Question One**

1-What are the differences between compilers and Interpreters?
2-What are the differences between the High level languages and Low level languages?
3-Explain the meaning of context free grammar?
4-What are the differences between:

- Static binding and Dynamic binding
- Persistent and imperative data structure in implantation of symbol tables
- Terminal symbols and Non terminal symbols

**Question Two**

1- For each description, write a regular expression to match it:

i. ab bb cb
ii. ab bb cb anb bnb cnb

2. For the regular expression you wrote in above question ,
   a. draw a **deterministic** finite-state automaton (DFSA)
   b. give the formal definition of the DFSA you drew
3- Write a regular expression for each of the following sets of binary strings. Use only the basic operations.
   a. all binary strings except empty string
   b. all binary stings begins with 1 and ends with a 1
   c. all binary stings ends with 00
   d. all binary contains at least three 1s

**Question Three**

1- What are the phases of compilers software?
2- Write grammars for each of the following languages:
a) All sequences of as and bs that contain the same number of as and bs (in any order).
b) All sequences of as and bs that contain strictly more as than bs.
3- What is the language denoted by the following RE
RE= (a+b)*(a+bb)
RE= (aa)* (bb)*b

**Question Four**

1-Divide the following equations to tokens indicate the type of each token
a:=x+y*2.5
2- Draw The NFA and DFA for the following language: $( a \mid b )^* abb$
3- Write grammars for each of the following languages:
a) All sequences of as and bs that contain the same number of as and bs (in any order).
b) All sequences of as and bs that contain strictly more as than bs.
c) All sequences of as and bs that contain a different number of as and bs.

**Question Five**

1- Define the term of ambiguity , what are the sources of this ambiguity?
2- For the following grammar
T→ R , T→ aTc , R→ , , R→ RbR
a- Draw two syntax tree for the string aabbbcc using the above grammar
b- Derive an unambiguous grammar for the above one.
3- Derive the string abbab using the following grammar
S→as, S→bS , S→a , S→b

**Problem number (4)** **(12 Marks)**

(a) Using radix-2 algorithm, obtain the 4-point FFT-DIF of the following sequence **[4 Marks]**

$$x(n) = \left\{ \underset{\uparrow}{1}, 2, 1, 1 \right\}$$

Follow exactly the corresponding signal flow graph and keep track of all the intermediate quantities by putting them on the graph.

(b) A difference equation describing a filter is given below: **[8 Marks]**

$$y(n) - \frac{3}{4} y(n-1) + \frac{1}{8} y(n-2) = x(n) + \frac{1}{2} x(n-1)$$

**Draw**

(i) Direct form I
(ii) Direct form II
(iii) Parallel form

**Problem number (5)** **(15 Marks)**

(a) Design an analog lowpass Butterworth filter with an acceptable attenuation in the passband of 0.8 at $0.2\pi$ radians/second, and attenuation in stopband of 0.2 at $0.6\pi$ radians/second.

**[7 marks]**

(b) Design a second order digital high pass Butterworth filter with the following specifications:

- A cutoff frequency of 2.4khz **[8 Marks]**
- A sampling frequency of 8khz.

**GOOD LUCK**

*Dr. Ali Abu Tahoun*

| $x(n)$ | $X(z)$ |
|---|---|
| $\delta(n)$ | $1$ |
| $u(n)$ | $\frac{z}{z-1}$ |
| $a^n u(n)$ | $\frac{z}{z-a}$ |
| $\sin(an)$ | $\frac{z \sin(a)}{z^2 - 2z\cos(a) + 1}$ |
| $\cos(an)$ | $\frac{z[z - \cos(a)]}{z^2 - 2z\cos(a) + 1}$ |

Tanta University

Department: Computer and Control Engineering
Total Marks: 70 Marks

Faculty of Engineering

| | | |
|---|---|---|
| Course Title: Digital Signal Processing | Course Code: CCE3116 | 3rd year |
| Date: January 26th 2012 (First Term) | Allowed time: 3 hrs | No. of Pages: (2) |

**Remarks:** (Answer the following questions... You may use the part of z-transform table given in page 2)

**Problem number (1)** **(18 Marks)**

(a) Discuss the following: **|12 Marks|**

(i) Linear and nonlinear systems

(ii) Time variant and time invariant systems

(iii) Causal and non-causal systems

(iv) Recursive and non-recursive systems

(v) The advantages of FFT over DFT

(vi) The mapping between s-plane and z-plane

(b) Consider the discrete-time sequence $x(n)$, **|6 Marks|**

$$x(n) = \left\{2, 1, 2, \underset{\uparrow}{0}, -2, -1, -2\right\}$$

**Sketch**

(i) $x(-n)+2x(n)$

(ii) $x(n+3)u(n+3)$

**Evaluate** the energy of $x(-n+3)$

**Problem number (2)** **(10 Marks)**

(a) Find the inverse z-transform of the following function as a weighted impulses **|4 Marks|**

$$X(z) = z^2\left(1-\frac{1}{2}z^{-1}\right)\left(1-z^{-1}\right)\left(1+z^{-1}\right)$$

(b) Find the z-transform and ROC for the following sequences **|6 Marks|**

(i) $x_1(n) = u(3n)$

(ii) $x_2(n) = \left[3(4^n) - 5(2^n)\right]u(n)$

**Problem number (3)** **(15 Marks)**

(a) Determine 8-point DFT of the following sequence **|7 marks|**

$$x(n) = \left\{\underset{\uparrow}{1}, -1, 2, 1\right\}$$

(b) Compute the linear convolution, $y(n) = x(n)*h(n)$, where **|8 Marks|**

$$x(n) = a^n u(n)$$

$$h(n) = b^n u(n), \quad \text{for constants } a \text{ and } b$$

*Hint: you may use the standard relation in finite series* $\sum_{k=0}^{N} a^k = \frac{a^{N+1}-1}{a-1}$

## *Question 4*

a) Many criteria have been suggested for comparing CPU-scheduling algorithms. State a set of scheduling criteria? Which criteria should be maximized? and which should be minimized?

b) Consider the following five processes using the multiple feedback queue-scheduling algorithm. Processes P1, P2, and P3 have priority 1, while processes P4 and P5 have priority 0 (the higher priority the sooner the process is scheduled). Their arrival times are 0, 1, 2, 0, 5 seconds and their run times are 1.5, 1, 2, 2, 2 seconds, respectively.

i- Draw Gantt charts illustrating the execution of these processes using the Round-Robin scheduling algorithm with a quantum time of 1 sec for the first level queue and 2 sec for the second level queue.

ii- What is the waiting time of each process for each of the scheduling algorithms in part i?

c) Define a semaphore? What are the necessary conditions that its operations must satisfy? What is the busy waiting? State the required changes to basic semaphore to deal with the busy waiting?

## *Question 5*

a) What is the difference between a deadlock and an unsafe state?

b) Consider the following snapshot of a system

| | Allocation | | | | Max | | | | Available | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | A | B | C | D | A | B | C | D |
| $P_0$ | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 2 | 1 | 5 | 2 | 0 |
| $P_1$ | 1 | 0 | 0 | 0 | 1 | 7 | 5 | 0 | | | | |
| $P_2$ | 1 | 3 | 5 | 4 | 2 | 3 | 5 | 6 | | | | |
| $P_3$ | 0 | 6 | 3 | 2 | 0 | 6 | 5 | 2 | | | | |
| $P_4$ | 0 | 0 | 1 | 4 | 0 | 6 | 5 | 6 | | | | |

Using the bankerś algorithm, answer the followings:

i- What is the content of the matrix Need?

ii- Is the system in a safe state?

iii- If a request from process $P_1$ arrives for (0,4,2,0). can the request be granted immediately?

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With my best wishes, Dr. Ing. Alsayed Algergawy

Tanta University
Faculty of Engineering
Computers & Control Eng. Dept.
Third Year

Operating Systems
First Term Exam
January 8, 2012
Time Allowed: 3 Hours

**Answer the following questions.**

## *Question 1*

Tell whether each of the following statements is true or false, and then correct the false ones:

a) A process can make a transition from the ready state to the waiting state.

b) As the degree of multiprogramming increases, the complexity of an operating system decreases.

c) Both the limit register and the relocation register have the same functionality in memory protection.

d) The preemptive scheduling algorithms are suitable for time-sharing systems.

e) Paging is a memory-management scheme that allows the logical space of a process to be noncontiguous.

## *Question 2*

a) Operating systems play as a user/computer interface. State the set of services provided by the operating systems to play this role?

b) What is a system call? What is its purpose? Mention the necessary system calls to read data from input file and write them into another file?

c) What is a process? What is a process control block? Draw the process state diagram?

d) What is a context switch? Is it necessary for the operating system? Why? What is the main drawback of context switching? Suggest a method to decrease this drawback?

## *Question 3*

a) Given a memory portion of 100K, 500K, 200K, 300K, and 600K in order, how would each of the first-fit, best-fit, and worst-fit algorithms place processes of 120K, 417K, 88K, and 426K in order

b) Explain what the multilevel (hierarchical) page tables are and their advantages over one-level page tables? How many pages can be in the virtual space using a two-level page table where every table has 1K entries?

c) What is a page fault? Briefly explain steps in handling a page fault?

d) A small computer has 4 frames. A process makes the following list of page-reference string: 1,2,3,4,1,5,2.3.1,2. How many page faults occur using FIFO, optimal, and LRU page replacement algorithms?

**Question 4**

(a) What does the acronym SQL stand for?

(b) Write a short account on the families of SQL elementary domains that allow representation of time instants and time intervals.

(c) Give a set of SQL commands that can construct a relation :

TRAINEE (ID, FirstName, Surname, Specialization)

with the following specifications:

- The attribute ID is a primary key, with domain char (10).
- The attributes FirstName and Surname are each subject to a constraint *not null*, with domain char (20).
- The attributes FirstName and Surname, taken together, are subject to a constraint *unique*.
- The attribute Specialization, with domain char (15), refers to an attribute Career in another relation TRAINER, thus forming a foreign key.
- The foreign key specified above has a correction policy *no action* for both deletions and updates.

(d) Do the commands of part (c) belong to the data definition language (DDL) or data manipulation language (DML)? Why?

(e) Modify the commands of part (c) so that the foreign key will have correction policies *set default* for deletions and *cascade* for updates.

(f) What do the correction policies *no action* in part (c) and *set default* and *cascade* in part (e) mean?

**Question 5**

Consider the relation STUDENT given in Fig.3.

**STUDENT**

| FirstName | Surname | Age | Faculty | Year |
|---|---|---|---|---|
| Adel | Helmy | 20 | Commerce | 1 |
| Alaa | Raafat | 21 | Engineering | 2 |
| Dina | Kamal | 20 | Science | 2 |
| Karim | Mostafa | 22 | Medicine | 3 |
| Noha | Abdel-Latif | 20 | Engineering | 2 |
| Salem | Mostafa | 23 | Medicine | 4 |
| Wael | Mostafa | 21 | Pharmacy | 1 |
| Zohdy | Saleh | 22 | Engineering | 3 |

Fig.3 Relation for Ques.5

Write SOL instructions for the following queries, showing the result in each case:

(a) Find the faculties of the students with surname Refaat. Rename the attribute Faculty as College.

(b) Find the first names and surnames of the students enrolled in year 2 of the faculty of engineering.

(c) Find the first names, surnames, and ages of the students enrolled in the faculty of engineering *or* the faculty of science.

(d) Find the first names of the students with surname Mostafa *and* enrolled in the faculty of medicine *or* the faculty of pharmacy.

(e) Find all available information of the students whose first names have an 'a' as the second letter and an 'm' as the last letter.

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***Prof. Dr. Mahmoud M. Fahmy***

**Tanta University**
**Faculty of Engineering**
**Computers and Control Department**

**Third Year Students**
**First Term Exam**
**January 22, 2012**

***DATABASE SYSTEMS*** ***Code : CCE 3112***

**Answer the following *five* questions. Time allowed: 3 hours.**

**Question 1**

(a) What is a data model? Discuss briefly its main types. Why is the *relational model*, in particular, the most widespread?
(b) List the advantages and disadvantages (if any) of a database management system (DBMS).
(c) The NULL values are adopted to solve the problem of incomplete information in relational models, but restrictions on the use of these NULLs do exist. Explain this statement with illustrative examples.

**Question 2**

(a) Prove mathematically that *every* relation has a key. Also differentiate between a key, superkey, primary key, and foreign key.
(b) Find the union, the intersection, and the two possible differences of the two relations of Fig.1, after appropriate renamings.
(c) In what sense are the selection and projection operators *complementary* to each other? For the relation PERSONNEL of Fig.1, find

$$\Pi_{\text{Surname}} (\sigma_{\text{Income} \geq 2000} (\text{PERSONNEL}))$$

**MENAGEMENT**

| Surname | Branch | Wages |
|---|---|---|
| Safwat | Alexandria | 2500 |
| Nassar | Cairo | 2500 |
| Hamed | Tanta | 2000 |
| Safwat | Mansoura | 2000 |

**PERSONNEL**

| Surname | Factory | Income |
|---|---|---|
| Safwat | Alexandria | 2500 |
| Nassar | Cairo | 2500 |
| Hamed | Tanta | 2000 |
| Safwat | Mansoura | 2000 |
| Hashem | Alexandria | 2100 |
| Mostafa | Cairo | 2100 |
| Morad | Tanta | 1800 |
| Sallam | Mansoura | 1800 |

Fig.1 Relations for Ques.2, parts (b) and (c)

**Question 3**

(a) Give a definition for the natural join of two relations. Show that this join can be simulated through three consecutive operations: renaming, equi-joining, and projection.
(b) Verify that the natural join of two relations with identical sets of attributes is the same as the intersection of the two relations, whereas the natural join of two relations with no attributes in common becomes a 'cartesian product' defined as the juxtaposition of a tuple from the first relation and a tuple from the second.
(c) Find the left, right, and full outer joins for the two relations of Fig.2.

**STAFF**

| StaffMember | Department |
|---|---|
| Fawzy | Computers |
| Kamel | Computers |
| Amin | Industrial Control |

**CHAIRMANSHIP**

| Department | Chairman |
|---|---|
| Computers | Farouk |
| Neuroscience | Abdel Rahman |

Fig.2 Relations for Ques.3, part (c)

Given an open-loop control state-space model, **[10 Marks]**

$$\dot{x} = \begin{bmatrix} 2 & 1 \\ 0 & -1 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} x$$

Design a state-feedback controller such that the closed-loop system poles have the values

$$s = -2, \quad s = -1$$

**Problem number (4)** **(15 Marks)**

(a) What is the difference between full-order state observer and reduced-order state observer? Derive an expression for the characteristic equation of the leunburger state observer. **[5 Marks]**

(b) A system is described by **[10 Marks]**

$$\frac{Y(s)}{U(s)} = \frac{4s + 1}{s^2 + 5s + 2}$$

(i) Find the observable canonical form.

(ii) Design a full-order state-observer that has an undamped natural frequency, $\omega_n$, of 10 rad/s and a damping ratio of 0.7.

**Problem number (5)** **(15 Marks)**

(a) What are the main types of optimal control problems? **[5 Marks]**

(b) A regulator contains a plant that is described by

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ 0 & -2 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} x$$

and has a performance index

$$J = \int_0^\infty \left[ x^T \begin{bmatrix} 2 & 0 \\ 0 & 1 \end{bmatrix} x + 4u^2 \right] dt$$

Determine

(i) The Riccati matrix $P$ **[5 Marks]**

(ii) The optimal state feedback matrix $k_{opt}$ **[3 Marks]**

(iii) The closed-loop eigenvalues **[2 Marks]**

**GOOD LUCK**

*Dr. Ali Abu Tahoun*

Tanta University

Department: Computer and Control Engineering
Total Marks: 75 Marks

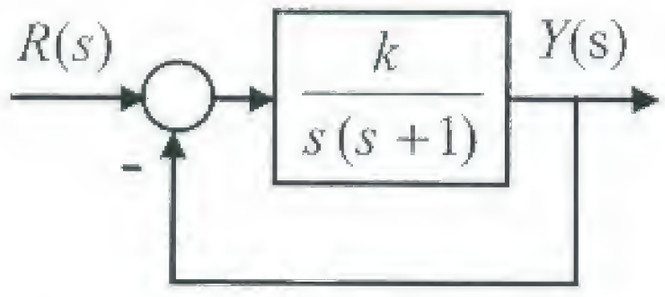
Faculty of Engineering

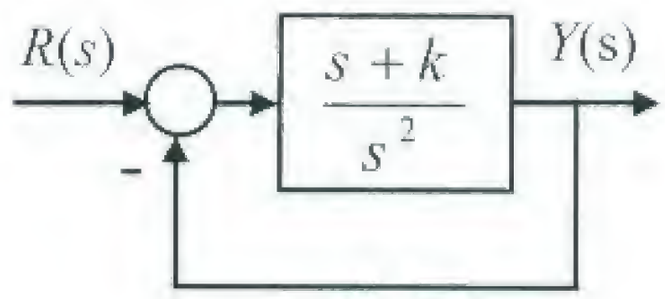
| | | |
|---|---|---|
| Course Title: Control Engineering | Course Code: CCE3115 | 3rd year |
| Date: January 15th 2012 (First Term) | Allowed time: 3 hrs | No. of Pages: (2) |

**Remarks:** (Answer the following questions... Assume any missing data)

**Problem number (1)** **(15 Marks)**

(a) For the following two block diagrams **[7 Marks]**




The root loci of the two systems are

(i) the same

(ii) different, Why?

(b) Consider the open loop transfer function, **[8 Marks]**

$$G(s) = \frac{K(2s+1)}{s^2+2s+2}$$

(i) Sketch the root locus.

(ii) Determine the value of $K$ such that the damped frequency, $\omega_d$, of a pair of dominant complex conjugate closed loop poles is 1.5 rad/s. Comment.

**Problem number (2)** **(15 Marks)**

(a) What is the meaning of gain-crossover frequency and phase-crossover frequency? Discuss the relationship between systems types and the corresponding bode diagrams. **[5 Marks]**

(b) For the system that has the open-loop transfer function **[10 Marks]**

$$G(s)H(s) = \frac{K(1+s)}{s^2(0.1s+1)(0.5s+1)}$$

Using bode diagram method

(i) Find the value of K for gain margin of 22 dB.

(ii) Find the value of K for phase margin of 45°.

**Problem number (3)** **(15 Marks)**

(a) Explain the effects of each term of PID controller on the system response. Why the I controller is used to eliminate the steady state error? **[5 Marks]**